DOCUMENT RESUME

ED 436 156 IR 019 781

AUTHOR Jannasch-Pennell, Angel; DiGangi, Samuel A.; Yu, Alex; Andrews, Sandra; Babb, John S.

TITLE Impact of Instructional Grouping on Navigation and Student Learning in a Web-Based Learning Environment.

PUB DATE 1999-02-00

NOTE 6p.; In: Proceedings of Selected Research and Development Papers Presented at the National Convention of the Association for Educational Communications and Technology [AECT] (21st, Houston, TX, February 10-14, 1999); see IR 019 753.

PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS Community Colleges; Comparative Analysis; *Computer Assisted Instruction; *Cooperative Learning; Decision Making; Design Preferences; *Grouping (Instructional Purposes); Individual Instruction; *Instructional Design; Instructional Effectiveness; Learner Controlled Instruction; *Navigation (Information Systems); Student Attitudes; Two Year Colleges; World Wide Web; Writing Instruction

IDENTIFIERS Home Pages; *Learning Environments

ABSTRACT

This study examines the effects and interactions of World Wide Web page design on student navigation and decision making in Web-based learning environments. The following research questions are examined via quantitative, qualitative, and exploratory data analysis procedures: (1) Does instructional grouping or Web page format effect navigational decisions in an online learning environment? (2) Are there differences in the number of unique URLs (Uniform Resource Locators) visited with respect to instructional grouping or Web page format? (3) Are there differences in student attitude toward instructional grouping or computer-mediated instruction? and (4) Are there differences in quality of students' written language with respect to instructional grouping or Web page format? Fifty undergraduate students enrolled in an introductory educational survey class at a large southwestern community college served as subjects. Each subject was randomly assigned to one of four groups: cooperative learning with advisement; cooperative learning without advisement; individual learning with advisement; and individual learning without advisement. Subjects participated in computer-mediated instruction employing Internet resources to gather information and compose an essay. An interaction between instructional arrangement and homepage design was observed with regard to navigation. No significant differences with respect to attitude and performance were observed. Implications for instruction, navigation, and interface design are detailed, and areas for further research are presented. (MES)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 436 156

Impact of Instructional Grouping on Navigation and Student Learning in a Web-Based Learning Environment

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

S. Zenor

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

Angel Jannasch-Pennell, Ph.D.
Samuel A. DiGangi, Ph.D.
Alex Yu, Ph.D.
Sandra Andrews. M.A.
John S. Babb, M.B.A.
Arizona State University

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Abstract

The development of effective web-based learning environments requires careful assessment of the impact of design variables on student learning. The present study investigates the effects and interactions of web-page design on student navigation and decision making in web-based learning environments. The following research questions are examined via quantitative, qualitative, and exploratory data analysis procedures:

* *Does instructional grouping or web page format effect navigational decisions in an online learning environment?*
* *Are there differences in the number of unique URLs visited with respect to instructional grouping or web page format?*
* *Are there differences in student attitude toward instructional grouping or computer-mediated instruction?*
* *Are there differences in quality of students written language with respect to instructional grouping or web page format?*

Fifty undergraduate students enrolled in an introductory educational survey class at a large southwestern community college served as subjects. Each subject was randomly assigned to one of four groups: cooperative learning with advisement, cooperative learning without advisement, individual learning with advisement, and individual learning without advisement. Subjects participated in computer mediated instruction employing Internet resources (World Wide Web) to gather information and compose an essay. Analysis of Variance and Chi Square procedures were applied to assess the relationship between independent and dependent variables. Significant differences were observed between instructional arrangement with regard to navigation (number of sites contacted and number of returns to the homepage). An interaction between instructional arrangement and homepage design was observed with regard to navigation. No significant differences with respect to attitude and performance were observed. Implications for instruction, navigation, and interface design are detailed. Areas for further research are presented.

Theoretical Framework

The theoretical basis for this comparison is grounded in the literature on cooperative learning, computer-mediated instruction, and learner control within hypertext environments. From a social cognition perspective, when students interact with their peers they are faced with ideas, explanations and information that are inconsistent with, or contradict, their prior knowledge and beliefs. Confronting these inconsistencies and contradictions challenges learners' current point of view, and resolving such cognitive conflicts results in cognitive restructuring (Bearison, 1982). When students receive new information from peers during group work, they presumably add detail to their existing cognitive schemas, explore and correct their misunderstandings, fill in gaps in their knowledge, and/or reorganize their knowledge structures (Bearison, 1982; Piaget, 1963; Vygotsky, 1978). During peer interaction, students are exposed to new strategies, terminology, and ways of thinking about problems; these experiences can restructure their own thinking, which may in turn affect their problem-solving behavior. From a social modeling perspective, peer interaction provides opportunities for imitation of successful problem-solving behavior. Both of these theoretical perspectives can cause changes in students' levels of competence as a result of peer interaction in small groups (Vygotsky, 1978).

Cooperative learning (CL) refers to instructional methods in which students are assigned to work in small, intentionally selected groups in which they are responsible both for their groupmates' learning (interdependent goal structures) as well as their own (individual accountability) (Mainzer, Mainzer, Slavin, Lowery, 1993; Stahl, 1994). One of the basic components of cooperative learning is a common concern or goal shared by the group of students, with each "team" member having a specific objective to be attained in cooperation with other group members. In CL, each member of the team, as well as the total group effort, is assessed in terms of productivity. Group success is typically assessed in terms of the supportive, contributive, and shared efforts of each team member toward the group attainment of a final outcome. CL provides for individual differences by enabling members to help one another to achieve the group goal (Slavin, 1982). Research indicates that students completing CL group tasks tend to have higher academic test scores, higher self-esteem, greater number of positive social skills, and greater comprehension

TM019781

BEST COPY AVAILABLE

of the content and skills they are studying, than those in traditional instructional situations (Johnson, Johnson, & Holubec, 1993; Johnson, Johnson & Smith, 1991; Slavin, 1991; Stahl, 1994; Stahl and VanSickle, 1992). In most CL situations, students are working in groups of two or more, mutually searching for understanding, solutions, and meaning, and/or creating a product. This emphasis on academic success/learning for each individual as well as for the group or team as a unit is one feature that distinguishes cooperative learning groups from other group tasks (Slavin, 1991; Stahl, 1994).

Little experimental research has been conducted on the use of cooperative learning in higher education. Dansereau (1988) examined the effect of cooperative learning strategies with university student and found that students gained more from learning in pairs than from working alone. Learning through interaction also transferred to individual achievement. Sherman (1986) used cooperative learning methods with university students enrolled in psychology courses, finding no significant differences on measures of achievement. Students in cooperative settings, however, rated their experiences more highly than those who were not in groups. Davidson (1990) reported similar results with college mathematics students. Frierson (1986) reported that nursing students studying cooperatively achieved higher scores on state nursing exams than a control group studying independently.

At the University of California, Berkley, enrichment workshops were formed that used cooperative learning techniques for in-coming African-American mathematics and science majors (Treisman, 1985). Grade point averages, retention rate and graduation rates were higher for students in the cooperative learning workshops than for a control group of students. In a meta-analysis of approximately 100 studies conducted with subjects at the college level, Bligh (1979) found that students who had in-class opportunities to actively interact with the instructor and with each other reported significantly higher levels of satisfaction with their learning experience than students in classes taught exclusively by the lecture method. Kulik and Kulik (1979) reported similar findings in their expansive review of the literature, concluding that students involved in classes which made use of discussion groups were more likely to develop positive attitudes toward the subject matter of the course (Cooper et al, 1990).

Although, research addressing the use of CL at the college level is somewhat limited, results to date are very consistent with those reported in pre-college settings (Cooper, Prescott, Cook, Smith, Mueck, & Cuseo, 1990, Johnson & Johnson, 1989; Johnson, Johnson & Smith, 1992). Procedural elements, which are critical to the effectiveness and ultimate success of CL, include:

- positive interdependence of group members (a feeling that the goal cannot be accomplished without everyone's involvement),
- face-to-face promotive interaction (engaging each other in an encouraging, supportive, and useful manner),
- individual accountability and personal responsibility (individual evaluation is contingent on individual performance),
- interpersonal and small group skills (knowledge and ability to perform functional group roles) and group processing (examining the workings of the group relationship) (Cooper et al, 1990, Johnson et al, 1989, 1992; Johnson et al., 1991; Stahl, 1994).

Because of limited access to computers, assigning groups rather than individuals to work at computers has been common practice in classrooms of all grade and academic levels for some time. Becker (1984) found in his national survey of k-12 schools that teachers assigned students to groups to work individually with computers 46% of the time. Several studies addressed group work with computers, finding group activities to facilitate positive peer interactions (Fisher, 1984; Mevarech, Stern, & Levita; Webb, 1984) and encourage social modeling (Johnson & Johnson, 1985). Students completing computer-meditated instruction in cooperative groups perform as well as and often better than students working alone (Carrier & Sales, 1987; Dalton, Hannafin, & Hooper, 1989; Hooper, 1992; Johnson, Johnson, & Stanne, 1985; Mevarech, Silber, & Fine, 1991; Shlechter, 1990). Within the past decade, research in the area of computer-mediated instruction (CMI) has demonstrated the positive effects of this method on achievement, attitudes, and learning (Mevarech, Stern & Levita, 1987). In the early 1980's, Kulik, Bangert, and Williams (1983, 1986) reported that 39 out 48 studies demonstrated the superiority of CMI programs over traditional instruction at the college and secondary levels of education. As indicated in their meta-analysis, CMI students scored .32 standard deviation higher on achievement tests than non-CMI students.

Cooperative CMI involves the instructional use of the computer combined with cooperative learning groups (Johnson & Johnson, 1986). Research has not extensively investigated the impact of cooperative CMI in small groups on students' social development, especially with adult learners. Studies involving highly structured cooperative learning settings have found that students using cooperative CMI perform better on achievement tests than students using CMI individually (Carrier & Sales, 1987; Johnson & Johnson, 1985). As both computer-assisted instruction and cooperative learning have demonstrated positive effects on student attitude and achievement (Kulik et al, 1983,1986; Slavin, 1980), the two strategies when combined hold potential for a robust instructional strategy (Kacer, Rocklin, & Weinholtz, 1991).

The presentation of the information in a computer-mediated setting can greatly influence student achievement. Early promoters of hypertext hailed it as a revolution in learning, allowing one to combine linear study with self-exploration and chance discovery. Some researchers believe that the organization of human memory is in

the form of associations between concepts and ideas, much like that of a hypertext document (Beasley & Lister, 1992). The use of hypertext documents may improve comprehension and learning by focusing on the relationship between concepts and ideas instead of isolated facts (Johassen, 1988; Kearsley, 1988). Several studies lend support to this theory by suggesting that comprehension can be improved when the material to be learned is presented in such a way that the learner has some degree of control over its sequence (Friend & Cole, 1990). Due to its flexibility, and the degree to which learners are forced to take an active role in their own learning, hypertext is attractive to educators who view the ideal learner as self-motivated and self-directed (Shin, Schallert & Saveny, 1994). Learner control is a commonly used in reference to instructional design that allows a student to make instructional decisions (Park, 1991; Shin et al , 1994). Reigeluth and Stein (1983) suggested that instructional effectiveness and efficiency improve as learner control increases. Learner control nurtures system independence by encouraging students to select and manipulate instruction according to their needs and stimulating them to invest greater mental effort in a task (Federico, 1980; Salomon, 1983, 1985).

Learner control has not been strongly associated with situations in which students work alone (Carrier, 1984; Hannafin, 1984; Milheim & Martin, 1991; Steinberg, 1977, 1989). Learner control appears to be most effective when prior knowledge is high (Hooper, Temiyakarn, & Williams, 1994). However, as indicated by Carrier (1984), students given learner control may not always make "good" choices. Learner control with advisement has been recommended when designing instruction delivered by computers (Carrier, 1984; Johansen & Tennyson, 1983; Santiago & Okey, 1992).

Several advisement strategies designed for improving students' choices under student control have been identified (Coorough, 1991; Goetzfield & Hannafin, 1985; Holmes, Robson & Steward, 1985; Johansen & Tennyson, 1983; Laurillard, 1984). Studies exploring the effects of advisement on learner control have reported that students who received advisement; a) achieved equal to higher scores on achievement tests when compared to non-advisement control groups (Holmes et al., 1985; Johansen et al., 1983; Tennyson, 1980), b) took longer to complete lessons than students in conventional learner control conditions, (Goetzfried et al, 1985; Johansen, 1983), and c) reported positive responses concerning advisement in learner control conditions (Laurillard, 1984).

The specific effects of learner control in cooperative learning groups remain unknown (Hooper, Temiyakarn & Williams, 1994). Students less knowledgeable of computers may function effectively in learner-controlled environments when paired with students who are more knowledgeable. More able partners will provide a model of effective learning that less knowledgeable students can emulate. Coupled with advisement in the learner control condition, these students will show marked achievement. Alternatively, dominate partners may impose their intentions on the group, which may have a negative effect for other members. In this situation, some students may benefit more from working individually than in groups.

The purpose of the present study is to examine the effects of instructional grouping and internet homepage format on student navigation in a network hypertext environment, attitude, and performance.

Methods and Techniques

Fifty undergraduate students (32 female, 18 male) enrolled in an education survey class at a large southwestern community college served as subjects. Students ranging in age from eighteen to forty-two where randomly assigned to one of four treatment conditions; cooperative computer-mediated instructional groups with navigational advisement, cooperative computer-mediated instructional groups without navigational advisement, individual computer-mediated instruction with navigational advisement, and individual computer-mediated instruction without navigation advisement. All students, regardless of assigned treatment received the same instructional content consisting of a twenty minute introductory lesson/demonstration on the basic elements of navigating through internet-based web sites. Following instruction, each subject was assigned randomly to e a treatment condition (advisement or no advisement). The screen design of the initial homepages differed in type of advisement provided (advisement vs. no advisement). In the advisement condition students viewed a homepage with directive advisement (Gleason, 1986), which included written suggestions for the student on how to navigate the lesson and a brief description of the hypertext links contained in the page. The no-advisement condition consisted of a home-page containing a list of hypertext links. The specific links provided on both pages were identical. Both pages were designed using the fundamental design principals and visual factors outlined by Faiola & DeBloomis (1988) concerning fonts, spacing, and basic graphic elements. Students were asked to write a brief essay detailing resources and applications available for students with special needs. They were provided with access to web-based search tools as a means of gathering information in support of their essay. Students' essays were evaluated by teachers enrolled in a post baccalaureate/masters teacher training program. Writing samples were assessed via a rubric adapted from the Arizona Student Assessment Program.

After completion of the task students were asked to complete a questionnaire focusing on their opinions and experiences related to computer-mediated activities (Love, 1969)

Dependent variables were navigation, attitude, and student performance. Navigation was assessed by 1) the number of links accessed by the student or group and 2) the number of times each student returned to the main

homepage. The network interface software recorded all hits and returns to a data file. Attitude was assessed through student responses to an attitude questionnaire. Quality of the written product was indicated by score for quality of writing as assigned by peer evaluators. The independent variables in this study were 1) instructional format and 2) advisement. A two (instructional format: cooperative groups vs. individual instruction) x two (advisement: advisement vs. no-advisement) experimental design was constructed to assess impact of each level of independent variable on the dependent variables.

Results and Conclusions

Educational Importance

Classical statistical procedures were employed to investigate the hypotheses. Analysis of Variance (ANOVA) procedures were applied to each dependent variable across levels of independent variable. All tests of significance were evaluated at the p=.05 level. The significant positive results in attitude among subjects in the group condition, and lack of difference found in student performance on the writing task across treatments, is consistent with the literature reviewed. Student indicate that interdependence, and the sharing of a common goal or outcome was present in most groups. Previous research indicates that pairing students based on ability, such as low-ability students paired with high-ability students, will show a greater effect on student achievement outcomes Hooper and Hannafin (1988). In the present study, students were randomly assigned to instructional based merely on chance, and no other factors were involved in the placement. Significant findings of the present study involve student navigational choices in a network hypertext environment. The interaction between the independent variables in regards to the number of unique sites visited indicates that students in cooperative learning groups across both levels of homepage format visited significantly more resource sites than students assigned to individual learning conditions. The results of this study indicate a critical need for research to continue in this area. Curriculum designers need to be aware of the influences different settings have on students working in network hypertext environments, this study lays the ground work for this subject to be addressed.

Discussion

The most intriguing findings of the present study relate to the impact of homepage format and instructional grouping on student navigation in the World Wide Web. The interaction between the levels of independent variables with regard to the number of unique URLs visited indicates that students in cooperative learning groups across both levels of homepage format visited significantly more resource cites than students assigned to individual learning conditions. Research geared towards the question of whether these students acquired more knowledge by viewing more homepages is yet to be adequately addressed. One explanation for this finding could be that students who work individually lose interest in the assignment at a faster rate than students working in groups. Conversely, students working individually may be spending more quality time on each homepage they visit than subjects in the cooperative learning group.

The significant positive results in attitude among subjects in the group condition and lack of difference found in student performance on the writing task across treatments is consistent with previous research. Although no significant differences were observed between groups in performance, cooperative learning groups did not appear to have any educational drawbacks. The high attitude scores indicated by the student questionnaires point to a potential advantage of group learning -- it permits the effective instruction of at least twice as many students as does instruction involving one person assigned to one machine. It is difficult to determine why there was not more of a difference between groups on quality of work. Previous research indicates that pairing students based on ability, such as low-ability students paired with high-ability students, will show a greater effect on student achievement outcomes (Hooper and Hannafin, 1988). In the present study, subjects were randomly assigned to instructional based merely on chance, and no other factors were involved in the placement. If subjects had been assigned to groups containing learners of varying levels of knowledge, perhaps a difference would have been found. Also the fact that writing samples were not first tested for sensitivity towards the measures can be another reason for the failure to find differences in student performance.

Diana and White (1994) suggest by combining three "high impact technologies": computer supported collaborative (or cooperative) work, computer-based learning, and the use of (multimedia) data bases for educational purposes, a kind of educational "Superinterface" will evolve and, in turn, bring dramatic changes in patterns of knowledge transfer in education. Curriculum designers need to be aware of the influences educational and instructional settings have on learners working in network hypertext environments such as the Internet. Instruction need no longer be restricted to the classroom; it may be extended to the virtual classroom or a virtual environment in which learning can take place. A class is made up a virtual community of learners. Time becomes a variable instead of merely a fifty-minute lecture. In a distributed learning environment, the entry point may vary with student preparation. The exit will change depending on the depth of mastery required. The length of the learning activity adjusts to fit the learner's needs, schedule and educational goals. Successfully achieving a distributed learning

environment requires the use of information technology and networked delivery of instruction through both synchronous and asynchronous communication. To create distributed learning environments, institutions must address both human and technological issues through planning, support from the community as a whole, and innovative architecture. The data on student navigation through the Internet has yet to be examined fully in the literature. The present study establishes ground work for future research targeting specific questions which may provide an empirical basis for development effective learning tools in computer mediated network communication environments.

References

Bearison, D. J. (1982). New directions in studies of social interactions and cognitive growth. In F. C. Serafica (Ed.), Social-Cognitive Development in Context, (pp.173-254). New York: Guilford Press.

Faiola, T. & DeBloois, M. L. (1988). Designing a visual factors-based screen display interface: The new role of the graphic technologist. Educational Technology, August, 12-21.

Gleason, J. M. (1986). The effects of learner control, prior knowledge of content, and advisement on test scores and the selection of Gagne's instructional events in a computer-based mathematics lesson (Doctoral dissertation, The University of North Carolina at Chapel Hill, 1986). Dissertation Abstracts International, 47, 054 (CD-ROM).

Hooper, S., & Hannafin, M.J. (1991). Psychological perspectives on emerging instructional technologies: A critical analysis. EDUCATIONAL PSYCHOLOGIST, 26, 69-95.

Love, W. P. (1969). Individual versus paired learning of an abstract algebra presented by computer assisted instruction. Washington, DC: Office of Naval Research.

Piaget, J. (1963). The Psychology of Intelligence. New Jersey: Littlefield, Adams, Patterson.

Vygotsky, L. S. (1978). Mind and society: The development of higher psychological processes (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Cambridge, MA: Harvard University Press.

BEST COPY AVAILABLE